PATENT APPLICATION

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of

Hans **BLOECHER**

Appln. No.:

Filed: **November 14, 2001**

For: **DEVICE AND PROCESS FOR AN ANTENNA ARRAY WITH SWITCHABLE WIDE ANGLE CHARACTERISTIC**

Attorney Docket No.: **3926.033**

PRELIMINARY AMENDMENT

Box: **PCT**
Honorable Commissioner of
Patents and Trademarks
Washington, D.C. 20231

Sir:

Prior to examination of the above-identified application, please amend the application as follows:

IN THE CLAIMS (CLEAN VERSION):

Please cancel original Claims 1-10; please add the following new Claims 11-20:

11. An antenna array comprised of individual antennas for increasing the directional resolution and angular coverage, in the sense of monopulse-antenna, of which the total antenna mean radiation pattern or directional characteristic is characterized by a sum diagram and a differential diagram,

wherein the individual antennas are connected via a network of phase-shifters or hybrid junctions,

wherein the antenna array includes a sum input for selecting the individual antennas, so that the antenna mean radiation pattern or directional characteristic exhibits a sum diagram,

wherein the antenna array includes a differential input for selecting the individual antennas so that the antenna mean radiation pattern or directional characteristic exhibits a differential diagram, and

wherein at least one of the phase shifters or hybrid junctions of the network is switchable, so that the antenna mean radiation pattern or directional characteristic exhibits further differential diagrams by the resulting change of the phase behavior due the selection of the individual antennas.

12. An antenna array according to claim 11,

wherein the network, by means in which the individual antennas are connected with each other, is comprised of a 3dB four-grid hybrid junction, two three-grid power dividers (5), a switch (6) for the alternating connection of the inputs and outputs of the antenna elements (8) and (9), the antenna elements (7) through (10), as well as the connecting lines between the components,

wherein the connecting line length between the antenna elements (7) through (10) and the inputs of the three-grid power dividers (5) are equal in length, in order to take into consideration the switch (6), and

wherein the inputs of the four-grid 3dB hybrid junction (4) are connected with the three-grid power divider (5) with and without a $\lambda/4$-detour line.

13. An antenna array according to claim 12, wherein the double switch (6) is realized by two 3dB hybrid junctions (13) and (14), two switches (15) driven in synchrony, and two circuit segments (16) and (17), wherein the two circuit segments (16) and (17) differ in their length so that the length difference corresponds to an uneven multiple of the half wave length of the waves passing through the device, and wherein the two 3dB hybrid junctions (13) and (14) are switched in series, so that one output from hybrid junction (13) is directly coupled with the input from hybrid junction (14), while a coupling of the other output from hybrid junction (13) and one of the two circuit segments (16) or (17) occurs via the switch (15).

14. An antenna array according to claim 12, wherein the switch (16) is a simple two way switch, with which it is possible to switch between a circuit of length L and a circuit of length L + $\lambda/2$.

15. An antenna array according to claim 14, wherein the switch (6) is a 3dB hybrid junction.

16. An antenna array according to claim 11, wherein for increasing the directional resolution, the antenna array is supplemented with an additional separate antenna element, and wherein this antenna element is positioned with such a spacing from the antenna array that, in the calculated complete diagram of the antenna arrangement, one of the two main lobes is totally or partially suppressed.

17. A process for operating an antenna array consisting of individual antennas in order to enhance the directional resolution and angular coverage, in the sense of a monopulse antenna, of which the common antenna mean radiation pattern or directional characteristic is associated with a sum diagram and a differential diagram, the process comprising:

connecting the individual antennas with each other via a network of phase shifters or hybrid junctions, such that the antenna mean radiation pattern or directional characteristic of the antenna arrays during selection via a sum input produces a sum diagram, and such that the antenna mean radiation pattern or directional characteristic of the antenna array upon selection of a differential input produces a differential diagram, and such that at least one of the phase shifter or hybrid junctions of the network is switchable such that the antenna mean radiation pattern or directional characteristic exhibits further differential diagrams due to the resulting change of the phase behavior upon the selection of the individual antennas.

18. A process according to claim 17, further comprising evaluating the phase difference between the differential and the sum channel according to the monopulse process for determining the entry direction of a received signal.

19. A process according to claim 17, comprising

driving the antenna elements non-symmetrically for determining the entry direction of a received signal, so that the antenna diagram is deformed, and

comparing the thus received signal at the differential channel with (a) the signal as tapped or received at the sum

channel or (b) the differential channel with the symmetric antenna diagram.

20. A process according to claim 17, further comprising making reference to the signal of an antenna element which in the calculated complete diagram of the antenna device completely or partially suppresses one of the two main lobes, and with reference thereto determining the entry direction of a received signal.

REMARKS

The specification and claims have been amended to conform the original translated specification and claims to U.S. requirements, i.e., appropriate section headers are added, reference in the specification to the claims have been amended in order to eliminate multiple dependent claims and claims improperly depending from multiple dependent claims, and to otherwise conform the claims to U.S. practice. Care has been taken to ensure that no new matter is added to the text.

Entry and favorable consideration prior to consideration are respectfully requested.

Respectfully submitted,

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Date: **November 14, 2001**

U.S. Application No.:
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Attorney Docket: 3926.033

EXPRESS MAIL CERTIFICATE

"EXPRESS MAIL" MAILING LABEL NUMBER: **EL568148105US**

DATE OF DEPOSIT: **November 14, 2001**

I HEREBY CERTIFY that the foregoing PRELIMINARY AMENDMENT and a stamped receipt post card are being deposited with the United States Postal Service "Express Mail Post Office to Addressee" service under 37 C.F.R. §1.10 on the date indicated and is addressed: **ATTN: Box PCT, Commissioner of Patents and Trademarks, Washington, D.C. 20231.**

The Commissioner is hereby authorized to charge any additional fees which may be required at any time during the prosecution of this application without specific authorization, or credit any overpayment, to Deposit Account Number 16-0877.

Bonnie L. Horst

VERSION WITH MARKINGS TO SHOW CHANGES MADE

The Examiner is requested to accept the marked-up version as it is based on the previous version, which when modified as below, produces the clean version submitted with the current amendment.

Please amend the claims as follows:

Please cancel Claims 1-10.

Please add the following new Claims 11-20:

--11. An antenna array comprised of individual antennas for increasing the directional resolution and angular coverage, in the sense of monopulse-antenna, of which the total antenna mean radiation pattern or directional characteristic is characterized by a sum diagram and a differential diagram,

wherein the individual antennas are connected via a network of phase-shifters or hybrid junctions,

wherein the antenna array includes a sum input for selecting the individual antennas, so that the antenna mean radiation pattern or directional characteristic exhibits a sum diagram,

wherein the antenna array includes a differential input for selecting the individual antennas so that the antenna mean radiation pattern or directional characteristic exhibits a differential diagram, and

wherein at least one of the phase shifters or hybrid junctions of the network is switchable, so that the antenna mean radiation pattern or directional characteristic exhibits further differential diagrams by the resulting

change of the phase behavior due the selection of the individual antennas.

12. An antenna array according to claim 11,

wherein the network, by means in which the individual antennas are connected with each other, is comprised of a 3dB four-grid hybrid junction, two three-grid power dividers (5), a switch (6) for the alternating connection of the inputs and outputs of the antenna elements (8) and (9), the antenna elements (7) through (10), as well as the connecting lines between the components,

wherein the connecting line length between the antenna elements (7) through (10) and the inputs of the three-grid power dividers (5) are equal in length, in order to take into consideration the switch (6), and

wherein the inputs of the four-grid 3dB hybrid junction (4) are connected with the three-grid power divider (5) with and without a $\lambda/4$-detour line.

13. An antenna array according to claim 12, wherein the double switch (6) is realized by two 3dB hybrid junctions (13) and (14), two switches (15) driven in synchrony, and two circuit segments (16) and (17), wherein the two circuit segments (16) and (17) differ in their length so that the length difference corresponds to an uneven multiple of the half wave length of the waves passing through the device, and wherein the two 3dB hybrid junctions (13) and (14) are switched in series, so that one output from hybrid junction (13) is directly coupled with the input from hybrid junction (14), while a coupling of the other output from hybrid

junction (13) and one of the two circuit segments (16) or (17) occurs via the switch (15).

14. An antenna array according to claim 12, wherein the switch (16) is a simple two way switch, with which it is possible to switch between a circuit of length L and a circuit of length L + $\lambda/2$.

15. An antenna array according to claim 14, wherein the switch (6) is a 3dB hybrid junction.

16. An antenna array according to claim 11, wherein for increasing the directional resolution, the antenna array is supplemented with an additional separate antenna element, and wherein this antenna element is positioned with such a spacing from the antenna array that, in the calculated complete diagram of the antenna arrangement, one of the two main lobes is totally or partially suppressed.

17. A process for operating an antenna array consisting of individual antennas in order to enhance the directional resolution and angular coverage, in the sense of a monopulse antenna, of which the common antenna mean radiation pattern or directional characteristic is associated with a sum diagram and a differential diagram, the process comprising:

connecting the individual antennas with each other via a network of phase shifters or hybrid junctions, such that the antenna mean radiation pattern or directional characteristic of the antenna arrays during selection via a sum input produces a sum diagram, and such that the antenna mean radiation pattern or directional characteristic of the

antenna array upon selection of a differential input produces a differential diagram, and such that at least one of the phase shifter or hybrid junctions of the network is switchable such that the antenna mean radiation pattern or directional characteristic exhibits further differential diagrams due to the resulting change of the phase behavior upon the selection of the individual antennas.

18. A process according to claim 17, further comprising evaluating the phase difference between the differential and the sum channel according to the monopulse process for determining the entry direction of a received signal.

19. A process according to claim 17, comprising

driving the antenna elements non-symmetrically for determining the entry direction of a received signal, so that the antenna diagram is deformed, and

comparing the thus received signal at the differential channel with (a) the signal as tapped or received at the sum channel or (b) the differential channel with the symmetric antenna diagram.

20. A process according to claim 17, further comprising making reference to the signal of an antenna element which in the calculated complete diagram of the antenna device completely or partially suppresses one of the two main lobes, and with reference thereto determining the entry direction of a received signal.--